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ABSTRACT

Part of a series of curriculum guides dealing with industrial education in junior high schools, this guide provides three units to be used in a one semester course in grade 9 on the subjects of bikes, electricity, and small engines. The section on bicycles is divided into two parts, mechanical and power (i.e. motorcycles) and covers the topics of bike tools and their uses, types of bikes, bike maintenance, safety and laws of cycling, engine repair and maintenance, and consumer knowledge. In the electricity unit the student becomes acquainted with the various tools, materials, and skills involved in electricity by engaging in activities exploring magnetism, basic sources of electricity, electric circuitry, home wiring, and career opportunities in the field. For the mini-course on small gasoline engines, the topics covered are as follow: basic engine construction, fuel systems, ignition systems, cooling systems, lubrication systems, trouble shooting and maintenance, career opportunities, and safety. Each unit contains a list of its goals, suggested demonstrations and learning activities, equipment needed, test questions, and bibliographies of printed and audiovisual materials. (ELG)

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INDUSTRIAL EDUCATION

Mini-Course - Grade 9: BIKES: MECHANICAL

PROGRAM DESCRIPTION

The course "Bikes" at the ninth grade level is a part of the mini-course cluster - Electricity, Small Engines and Bikes. The course consists of two main basic areas - Mechanical and Power. Classes meet fifty minutes daily, five days a week for six weeks.

The course is basic and exploratory in nature. Basic study and activities will involve bike tools and their uses, types of bikes, maintenance of bikes, safety and laws of cycling, engine repair and maintenance, and consumer knowledge.

Goals

1. The students will understand bikes in regard to selection to meet individual needs.

2. The students will understand the proper use of tools and safety procedures used during the maintenance operations.

3. The students will understand proper maintenance and adjestment to insure safe operation for the rider and non-rider.

4. The students will understand laws and safety regulations for on and off street use.

5. The students will develop manipulative skills through hands-on activities.

6. The students will develop an understanding of the value of caring for and maintaining his equipment.

7. The students will understand that two wheel vehicles are an alternative form of travel.

8. The students will explore the career opportunities associated with two wheel vehicles.

9. The students will have an understanding regarding consumer knowledge.

BIKES:MECHANICAL - Unit I - Review of Tools

Unit II - Types of Bicycles - Basic Description

Unit III - Maintenance

Unit IV - Laws and Safety Regulations

Unit V - Bibliography

BIKES: MECHANICAL - Unit I - Review of Tools

Objectives for Goals 2, 3, 5, 6.

1. The students will be able to identify and properly use tools needed for proper maintenance of bicycles.

Suggested Demonstrations and Activities

1. Display all tools on a work bench and discuss each one and demonstrate its use.
2. Students can practice with tools that are not familiar to them.
3. An identification quiz or test can be given.
4. Lesson on conversion of Standard measurements to Metric measurements is optional.

REQUIRED	SKILLS	TEST QUESTIONS
Tool set with metric wrenches: 1. box wrench 2. open end wrench 3. socket wrench 4. allen wrench 5. adjustable wrench 6. screwdrivers 7. pliers 8. hammer	Tools are to be identified and their use demonstrated and experienced by the students.	Identification quiz
Specialized tools: 1. chain rivet tool 2. spoke wrench 3. hub removal tool 4. cone wrenches 5. air compressor inflation attachment 6. tire irons		
Lubricants: 1. light oil 2. bearing grease		
Orderly storage facility		

BIKES: MECHANICAL - Unit II - Types of Bicycles - Basic Description

Objectives for Goals 1, 7, 8, 9.

1. Students will distinguish between different types of bicycles, their advantages and disadvantages, and the needs that each fulfills, especially for themselves.

Suggested Demonstrations and Activities

1. Each can bring in his own bicycle and tell the class what type it is and how well he likes it.

2. Types of bicycles that may not have been brought in by students can be discussed by the instructor. This can include antique styles an some history of the bicycle.

REQUIRED	SKILLS	TEST QUESTIONS
Types of bicycles: 1. Coaster-single speed emphasis on Bendix system 2. Hub geared bikes - 2, 3, 4, 5 speed bikes 3. Derailleur - 5, 10, 15 speed bikes	Factors to consider before buying: (for discussion) 1. seat 2. frame, type & size 3. handle bars 4. levers to controls 5. tire size & design balloon or racing tires 6. uses - to include no. of speeds, durability, & weight a. recreational b. long distance c. racing d. other 7. quality 8. price	Identification quiz

(Examples brought in by students might be used as well as Consumer Guide Bicycle Test Reports, pages 6-10)

Students will tell why they chose their bike & knowing what they know now, would they choose differently.

BIKES: MECHANICAL - Unit III - Maintenance

Objectives for Goals 2, 3, 4, 5, 6.

1. Students will be able to perform the necessary maintenance and adjustments to keep or return the bike to proper working and safe order.

Suggested Demonstrations and Activities

1. Seat - adjustment and conditioning
2. Handle bars - adjustment, levers, and taping
3. Brakes, coaster, caliper, and disc brakes
4. Bearing adjustments and maintenance - hubs, steering head, and crank set
5. Chain free play and pedals - cleaning, lubricating, and adjusting
6. Hub controls - 3 speed, single speed, 10 speed, and quick release
7. Derailleurs - front and rear
8. Tires and tubes - proper air pressure, tube repair, sew ups, wired on, and tread designs
9. Wheels and rims - spoke adjustment and replacement, repair of rim dents
10. All repairs will be tested in the parking lot - competition braking, speed, etc.
11. Students that have enough knowledge of a particular area may do the demonstration of the day for the rest of the class.

REQUIRED	SKILLS	TEST QUESTIONS
Bike, lock, chain or cable	Bike is to be locked in such a manner as to foil theft of vehicle and wheels. This simple but important lesson will be included early in the course.	
Bicycle with adjustable seat. Metric and Fractional wrench sets	Students are to know the why and how of seat adjustment: 1. height 2. angle 3. fore and aft (sliding) 4. tension Students will learn how to condition the seat: 1. oiling (leather seats) Students will adjust seats on their own bikes.	How do you determine the height of the seat?

REQUIRED	SKILLS	TEST QUESTIONS
Bicycle equipped with conventional handle bars and one with a Maes handle bar	Students will be knowledgeable on how to adjust the handle bars in relation to the seat: 1. height 2. angle adjustment Levers should be positioned correctly. Students will also know the correct taping procedure for Maes handle bars.	Handle bars are adjusted in relation to what?
Bicycles equipped with coaster, caliper, & also, perhaps disc brakes. Wrench sets and screwdrivers will be needed	Inspect and test brakes. Students must be able to stop in a specified distance. Caliper brakes must <u>not</u> ride on the tire (center pull & side pull)	
Bicycle, multi-purpose grease, wrench sets, & bearing wrenches	Bearings are to be inspected, lubricated, & Maintained according to manufacturer's specifications in order to insure prolonged life of bearing surfaces & mechanisms. These bearings include: 1. hub 2. steering head 3. crank set	Explain the procedure involved in proper hub bearing adjustment.
Bicycle, wrench set, and chain rivet tool	Students are to adjust their own chain to manufacturer's specifications. Lubrication and maintenance must be performed. Pedals are not to be bent, but straight and easily turned. Toe clips must be explained to avoid any potential hazards.	

REQUIRED	SKILLS	TEST QUESTIONS
3-speed hub bike and tool set, Single speed hub bike and tool set and ten speed hub bike and tool set	3-speed hub bike - adjust hub control so that the gears will shift smoothly and without any damage or slipage. Clean and lubricate hub on single and 10-speed bikes.	
Two 10-speed bikes: one with a push rod Derailleur and one with a parallel-ogram Derailleur	Students will distinguish the difference between the two types of Derailleurs and will be able to maintain them by cleaning, lubricating, and adjusting properly.	
5, 10, or 15 speed bike and tool set	Adjust rear Derailleur to prevent the chain from coming off. Also clean and lubricate to insure easy movement during gear changes.	
Examples of different tread designs and tubes	Complete removal of wheel, tire, and tube. Repair of damaged tube and reassembly of all components. Inflate tire to proper pressure using hand pump and compressor. Brief explanation of sew-up and wired on tires.	
Any bicycle rim and spoke adjusting tool	Spokes will be checked for alignment and tension. Explain use of the spoke adjusting tool. Out-of-round wheels should be done only by a professional.	

BIKES: MECHANICAL - Unit IV - Laws and Safety Regulations

Objectives for Goals 2, 4, 8, 9.

1. Students will learn and demonstrate laws and rules of good cycling.

Suggested Demonstrations and Activities

1. Have a policeman come in as a guest speaker.
2. Take a bike hike to practice and demonstrate safe cycling. This might also serve as a practical test.
3. Design safety posters (with cooperation of art department), to be posted throughout school.

REQUIRED	SKILLS	TEST QUESTIONS
Each student: copies of Bike Riders Manual Also helpful: Consumer Guide Bicycle Test Reports, page 141	TThe bicycle is considered a vehicle subject to the laws governing automobiles. Discuss laws about vehicle operation and equipment. With the help of the free booklet from the Department of Highway Safety, the students should be able to operate his bicycle within the limits of the law. Safety rules and procedures to cover: 1. defensive driving in traffic 2. riding in groups 3. carrying equipment 4. dealing with hazardous road surfaces 5. clothing 6. attitude	
Seek a competent bicycle repairman to come to class. Various repair shops can be found in the phone book.	Speaker can give a talk concerning the general care and maintenance needed on a bike and the careers in the bike industries.	
Contact Roehm Jr.High to obtain a speaker from their bicycle class.	In the summer of 74, the Bicycle class from Roehm Jr. High went on a bicycle tour of Europe. It would interest the students to hear and ask questions about their adventures on two wheels.	

BIKES: MECHANICAL - Unit V - Bibliography

Anybody's Bike Book, Tom Cuthbertson, The Ten Speed Press, 1971

The Best of Bicycling, Edited by Harley M. Leets, Published by Pocket Books, 1972.

Bicycle Digest, Mark Thiffault, Follett Publishing Company.

Bicycle - Two Wheel Travel, Camping and Touring, Peter W. Tobey, Tobey Publishing Company, 1972.

Bike Riders Manual, Department of Highway Safety, 240 Parsons Avenue, Columbus, Ohio 43215.

Complete Bicycle Book, Peterson Publishing Company.

Consumer Guide - Bicycles Complete Buying Guide, Popular Library.

* Consumers Guide - Bicycle Test Reports, Doubleday & Company.

* Fix Your Bike, John W. McFarlane, Follett Publishing Company.

Glenn's Complete Bicycle Manual, Clarence W. Coles and Harold T. Glenn, Crown Publishing, 1973

How to Fix Your Bicycle, Technical Publications Division, Intertec Publishing Corporation, 1973

Richard's Bicycle Book, Richard Ballantine, Ballantine Books.

* Indicates important publications

BIKES: POWER

Program Description

This is the second half of the bike unit. This section will deal with self-propelled vehicles; mainly mini-bikes, motorcycles, and all-terrain vehicles.

This course has been written with the thought and home in mind that the students enrolled will be able to bring to school an assortment of vehicles to supplement other visual aids for discussions, and also provide an opportunity for hands-on experiences in the maintenance and learn-t-ride units.

Review of tools, basic mechanics, and metrics has been discussed at the beginning of the bike and small engine units. The only additional tools needed are flat and round feeler gauges.

BIKES: POWER - Unit I - History of Cycles
Unit II - Choosing a Vehicle
Unit III - Maintenance
Unit IV - Tips on How to Ride a Motorcycle
includes: Legal Implications
Unit V - Bibliography

BIKES: POWER - Unit I - History of Cycles

Objectives for Goals 2, 7, 8.

1. The students will be knowledgeable of the early cycles, their growth of popularity, and the present status of cycles.

Suggested Demonstrations and Activities

1. Lecture on the history of motorcycles.
2. Discussion of what other types of vehicles have grown out of the motorcycle - snowmobiles, etc.
3. The students will analyze the roll of the motorcycle in the energy crisis both for the present and the future.

REQUIRED	SKILLS	TEST QUESTIONS
Examples and visual aids of the history of motorcycles	The students will learn about: 1. the first motorcycles made 2. why it was made 3. its growth in popularity 4. what part they play in the energy crisis 5. what extent they are used today 6. will they play a large part in the future in connection with the energy problem	

BIKES: POWER - Unit II - Choosing a Vehicle

Objective for Goals 1, 9.

1. The students will be aware of the factors and differences in power bikes, be able to recognize them, and make intelligent consumer choices.

Suggested Demonstrations and Activities

1. Discussion of different types of vehicles using examples that the students bring in and visual aids.

2. Movies of motorcycle races to better understand the type of bike that is used.

3. Invite a representative from one of the motorcycle sales offices to speak about the different sizes and types of bikes available.

4. Hand out a check list of factors needed in making a wise choice. The students will follow the list and at the end of the unit they will make a choice of a motorcycle that best suits the factors they have checked off for themselves.

REQUIRED	SKILLS	TEST QUESTIONS
Examples and/or visual aids of bikes that are on the market today	Students will know the differences between bikes. The types are: 1. mini bike - cycle 2. trail - woods 3. trail - street 4. street scrambler 5. hill climber 6. racing	
Visual aids dealing with the different uses for motorcycles	Students will know the variety of uses for motorcycles: 1. recreational 2. on and off the street 3. racing 4. transportation 5. law enforcement	

REQUIRED	SKILLS	TEST QUESTIONS
Examples and/or visual aids	Students will learn the different sizes of each type of bike. This includes: 1. frame - weight factor 2. engine 3. tires 4. wheel-base	
Examples and/or visual aids	Students will be able to make a final check before making a decision on what type of bike to buy. Check: 1. overall workmanship - finish 2. is engine easy to start? 3. do any parts strike the bike? 4. does it sound in good condition? 5. do the levers work smoothly? 6. are the mufflers too noisy? 7. is the instrumentation adequate? 8. is the headlight bright? 9. does it stay bright at idle? 10. are the controls placed correctly? 11. are they easy to operate? 12. is the dealer reputable? (parts and service) 13. is the price right?	

BIKES: POWER - Unit III - Maintenance

Objective for Goals 2, 3, 5, 6.

1. The students will learn the general fundamentals needed for proper maintenance and repair of small engine vehicles.

Suggested Demonstrations and Activities

1. Show various movies dealing with internal cumbustion, ignition, etc.

2. Review:
   a. spark plugs - clean, regap, check spark
   b. carburetor - clean and adjust, check linkage
   c. air cleaner - clean or replace
   d. ignition system - tune up engine, replace parts if needed
   e. starting system - practice the correct procedure of starting a small engine vehicle
   f. clutch - centrifugal and mechanical operations
   g. brakes - drum and disc
   h. chain - clean, lubricate, tighten and align
   i. wheels and rims - spoke adjustment and replacement
   j. tires - proper air pressure, tube repair, tread designs
   k. lights - adjust and replace

REQUIRED	SKILLS	TEST QUESTIONS
A Safety Check List hand out See inserted page for list.	The students will be able to recognize the items on the list. The items should be checked frequently in order to operate safely.	
Some type of small engine vehicle or an engine alone, tool set	Remove spark plug and see how well it was firing. Clean and regap to manufacturer's specs. With the spark plug still out, connect the wire and turn the engine over by hand and see what type of spark jumps the gap. Replace plug if it is adequate.	

REQUIRED	SKILLS	TEST QUESTIONS
Some type of small engine vehicle or an engine alone, tool set	Clean the external area of the carburetor before any work is performed. The high speed valve is to be adjusted first. Find the spot where the engine runs the smoothest and turn outward just enough to make it run slightly rough. Return to idle and set the idle speed screw. Adjust the idle mixture screw until it runs smoothly. Re-adjustment of the idle speed screw may be necessary. Adjust linkage and cables	
Example and/or visual aids of different types of air cleaners	The students will know the 3 different types of air cleaners and how each is maintained: 1. paper element 2. oil bath 3. oil soaked sponge	
Some type of small engine vehicle and tool set	The students will learn the proper procedure for changing the oil and filter. On some types of vehicles the crankcase and gear box are together and use the same oil system. Check the manual to see if the procedure is different in this case.	
Tool set and feeler guages, small engine vehicle, D.C. voltmeter	The students will learn the fundamentals of ignition from the magneto to the battery generator type of system. On any system, check the point gap and set to specifications. Adjust magneto magnets. Check for properly insulated and grounded wires. Battery and generator should be checked for proper output. Rotor, distributor cap, coil, and condensor should be checked.	

BIKES; POWER - Unit III - Maintenance: SAFETY CHECK LIST

DATE OF CHECK: _____

ITEM:	GOOD	QUESTIONABLE	REPLACED/READJUSTED
1. Lights	___	___	___ /___
2. Horn	___	___	___ /___
3. Bolts	___	___	___ /___
4. Tires	___	___	___ /___
5. Rear visibility	___	___	___ /___
6. Brakes	___	___	___ /___
7. Chain	___	___	___ /___
8. Battery	___	___	___ /___
9. Clutch and transmission	___	___	___ /___
10. Fuel tank	___	___	___ /___
11. Lock	___	___	___ /___

DATE OF CHECK _____

ITEM:	GOOD	QUESTIONABLE	REPLACED/READJUSTED
1. Lights	___	___	___ /___
2. Horn	___	___	___ /___
3. Bolts	___	___	___ /___
4. Tires	___	___	___ /___
5. Rear visibility	___	___	___ /___
6. Brakes	___	___	___ /___
7. Chair	___	___	___ /___
8. Battery	___	___	___ /___
9. Clutch and transmission	___	___	___ /___
10. Fuel tank	___	___	___ /___
11. Lock	___	___	___ /___

BIKES: POWER

Program Description

This is the second half of the bike unit. This section will deal with self-propelled vehicles; mainly mini-bikes, motorcycles, and all-terrain vehicles.

This course has been written with the thought and home in mind that the students enrolled will be able to bring to school an assortment of vehicles to supplement other visual aids for discussions, and also provide an opportunity for hands-on experiences in the maintenance and learn-t-ride units.

Review of tools, basic mechanics, and metrics has been discussed at the beginning of the bike and small engine units. The only additional tools needed are flat and round feeler gauges.

BIKES: POWER - Unit I - History of Cycles
Unit II - Choosing a Vehicle
Unit III - Maintenance
Unit IV - Tips on How to Ride a Motorcycle
includes: Legal Implications
Unit V - Bibliography

BIKES: POWER - Unit I - History of Cycles

Objectives for Goals 2, 7, 8.

1. The students will be knowledgeable of the early cycles, their growth of popularity, and the present status of cycles.

Suggested Demonstrations and Activities

1. Lecture on the history of motorcycles.
2. Discussion of what other types of vehicles have grown out of the motorcycle - snowmobiles, etc.
3. The students will analyze the roll of the motorcycle in the energy crisis both for the present and the future.

REQUIRED	SKILLS	TEST QUESTIONS
Examples and visual aids of the history of motorcycles	The students will learn about: 1. the first motorcycles made 2. why it was made 3. its growth in popularity 4. what part they play in the energy crisis 5. what extent they are used today 6. will they play a large part in the future in connection with the energy problem	

REQUIRED	SKILLS	TEST QUESTIONS
Small engine vehicle with a mechanical starting system, and tool set	The students will learn the 2 ways to start an engine mechanically: 1. pull rope start 2. kick start No maintenance is really required for the pull rope, but the kick start has a few minor things to check: 1. worn rubber on the starter pedal 2. spring tension 3. bent pedal 4. gears internally are not sloppy and worn	
Small engine vehicle with an electrical starting system, and a tool set	Tighten and inspect all electrical connections. Check electrolyte level in the battery. The starter motor must be checked so that it is in proper position to insure smooth meshing of the starter gears. The starter switch must be checked and contacts cleaned.	
Small engine vehicle with a centrifugal clutch, and a tool set	Clutch is a simple device, but must be maintained correctly for satisfactory performance. 1. lubricate basking & bearing according to specifications 2. check spring tension 3. check drum for wear or warpage 4. check shoes for wear or oil impregnation	
Small engine vehicle with a mechanical clutch, and a tool set	Clutch cable or linkage is usually provided to adjust for cable stretch or wear, and wear on the clutch plate itself. The cable or linkage will be adjusted by manufacturer's procedure so that the clutch does not slip when engaged and does not drag when disengaged.	
Small engine vehicle with a drum brake mechanism, and a tool set	The wheel will be disassembled to expose the brake shoes. 1. inspect brake shoes for wear and cracks 2. inspect the drum for hot spots and grooves 3. check spring tension to insure proper contraction of the brake shoes	

REQUIRED	SKILLS	TEST QUESTIONS
	4. replace needed parts and reassemble Adjust brake cable or rod to manufacturer's specifications. Lubricate all cables and rods to insure against wear and breakage.	
Small engine vehicle that is chain driven, and tool set	Chain is cleaned by soaking in solvent. Lubricated by soaking in oil, wiped off and outside sprayed with dry lubricant to prevent dirt build-up. Check chain for wear - "stretch" should not exceed ½' per foot. Chain should be replaced if worn excessively. It is best to replace sprocket when replacin chain. Check sprockets for alignment. Install chain and adjust free play.	
Vehicle with wire wheels, screwdriver, spoke wrench, replacement spokes	Check spokes for tightness by tapping each spoke with a screwdriver and listening for the same pitch sound from each. Tighten loose spokes with spoke wrench. Replace broken or damaged spokes after air pressure in tire is reduced. Unthread hub end and unscrew rim end without puncturing tube. Thread new spoke in place and tighten. Retighten after a few hours use. If inner spokes differ from outer spokes, replace accordingly.	
Small engine vehicle with various switches, controls, and indicators, and a tool set	Switches, controls, and indicators must be kept in proper working order to insure safe operation of the vehicle. The students will become familiar with all controls and their placement. Any burned out light bulbs will be replaced. Switches that stick or do not function will be replaced. The speedometer cable will be lubricated and kep in proper working order.	

REQUIRED	SKILLS	TEST QUESTIONS
Examples and/or visual aids of different types of tire tread designs	Students will learn about the different tread designs for motorcycles and for what purpose each of these is used. The students will also know why a motorcycle tire tread is round on the edges, rather than flat like an automobile tire. Proper tire inflation and changing will also be shown and practiced.	
A motorcycle or minibike equipped with headlight, tail light, stoplight, license plate light, and directional signals; wrenches and screwdriver	Headlight will be adjusted so that it illuminates the road area effectively. Tail lights, stop lights, and directional signals and license plate light will be checked and bulbs replaced, if necessary The importance of these lights, according to the law and from the safety standpoint, will be stressed.	

BIKES: POWER - Unit IV - Tips on How to Ride a Motorcycle

Objectives for Goals 3, 4.

1. The students will know the learn-to-ride procedure and see it demonstrated.

2. The students will be aware of the legan and technical matters as well as those of attitude which lead to safe cycling.

Suggested Demonstrations and Activities

1. Invite a motorcycle police officer to the class to speak on the laws governing the use of two wheeled vehicles on the streets and highways.

2. One of the more mature students can demonstrate the proper learn-to-ride procedure on a vehicle in the parking lot.

3. A student can wear or use visual aids to show proper clothing to be worn to reduce injury in case of an accident.

REQUIRED	SKILLS	TEST QUESTIONS
Example and/or visual aids of motorcycles	Students will learn location and use of all controls including: 1. throttle control 2. brakes 3. clutch 4. gear shifter 5. starter 6. headlights 7. directional lights 8. horn 9. etc. Each student should have the opportunity to sit on a bike and handle all the controls. Students will be instructed in the preventative maintenance of these controls, if not covered earlier in the course.	
Visual aids of people operating a bike in a safe manner	The attitude of a motorcycle operator is most important. The students will learn that they should not be arrogant and inconsiderate. Dangerous situations can be created by: 1. carlessness 2. high speed 3. over confidence 4. a disregard of the bikes limitations	

REQUIRED	SKILLS	TEST QUESTIONS
	The students will learn to be cautious and not let the thrill of high speed sway them from a mature attitude.	
Examples and/or visual aids of proper wearing apparel NOTE: Passengers should also wear the same type of clothing	Students will recognize the need to have a specific type of clothing and the safety reason for each article, such as: 1. approved helmet - preferably white 2. goggles 3. light or bright jacket 4. gloves 5. proper footwear 6. wear long pants - eliminates leg burns from hot exhaust pipes	
Obtain the pamphlet on Motorcycle Laws to hand out to each student. See Bibliography.	The students, with the aid of the instructor, will read the pamphlet and translate the laws into a simplified form so the students may better comprehend their meanings. This will include equipment regulations and licensing procedures, such as: 1. handlebars - height & narrowness 2. mufflers 3. mirrors - numer & placement 4. seats 5. windshields - eye protection 6. helmets 7. brakes 8. lights - number & placement	
Handout of procedure for learning to ride. See insert. Motorcycling for Beginners, Chap. 2 & 3	Review procedure for learning to ride and discuss chapters 2 and 3 in Motorcycling for Beginners.	
Motorcycle or minibike in a large parking lot	After a review of procedure for learning to ride, the procedure will be demonstrated to class by a competent student. This is not meant as a unit in learning how to ride, but will show the recommended procedure that should be used when the students wish to learn how to ride.	
Copies of Mini-Trail Riding Tips from Honda	Assimilate the information in this pamphlet and discuss related matters of safety.	

BIKES: POWER - Unit IV - Tips on How to Ride A Motorcycle - HANDOUT

RIDE AS A PASSENGER FIRST BEFORE DRIVING!

Before starting the engine:

1. Know where everything is on the bike and what it is called.
2. Comprehend throttle use.
3. Coordinate clutch and throttle use.
4. Manipulate front and back brakes.
5. Practice sitting correctly.
6. Demonstrate balance while being pushed.
7. Practice going down a hill without the engine running to get used to the braking system and improve on your balancing.

PRACTICE STARTING AND STOPPING THE ENGINE!

First ride under power:

1. Find neutral.
2. Get feel of throttle, clutch, and brake.
3. Stay in first gear.
4. Stay out of traffic. Use a parking lot.
5. Practice driving a straight course; practice turns.
6. Practice going down a hill with the engine running.
7. Practice emergency stops.
8. Start shifting gears.
9. On the road: Watch for hazards.

   Use correct passing procedures.

   Parking

   Special problems

   Know trail riding tips.

NOTE: Neither a mini-bike nor a regular motorcycle may be operated in city streets without registration and the rider must also posses a permit or license, depending on state regulations.

BIKES: POWER - Unit V - Bibliography

Concepts for Traffic Safety, Motorcycling in the Schools, Aetna Life & Casualty.

Handbook of the Driver Education Program for Motorbike Operators, Universal Underwriters Insurance Co., Kansas City, Missouri.

Materials - Pass outs from local dealers

Minibike Service Manual, 2nd Edition, Technical Publications Division, Intertec Publishing Corporation.

Mini Trail Riding Tips, from Honda

Motorcycling for Beginners, I. G. Edmonds, MacRae Smith Co. Publishers.

Motorcycles, How They Work, Charles Yerkow, G. P. Putnam's Sons, New York, 1971

Motorcycle 4-Stroke Service Manual, 3rd Edition, Vol. 2, Technical Publications Division, Intertec Publishing Corporation.

Motorcycles, Ohio's Regulations Governing Motorcycle Safety Equipment and Licensing of Operators (pamphlet), Director of Ohio Department of Highway Safety, 240 Parsons Avenue, Columbus, Ohio 43215.

Policies and Guidelines for Motorcycle Education, National Commission on Safety Education, N.E.A., 1201 Sixteenth Street, N.W., Washington, D.C. 20036.

**Hand-Outs on Safety Check List and Procedure to Learn How to Ride

INDUSTRIAL EDUCATION

Mini-Course - Grade 9: ELECTRICITY

PROGRAM DESCRIPTION

Electricity is an elective course that is offered at the ninth grade level for boys and girls in the junior high schools. Classes meet fifth minutes daily, five days a week for six weeks.

This course is one of three courses offered as a semester unit in Industrial Education. The unit consists of Electricity, Small Engines, and Bicycles.

Electricity in the ninth grade is exploratory in nature. The students will become acquainted with the various tools, materials, and techniques involved in electricity by engaging in activities regarding magnetism, basic sources of electricity, simple electric circuits, home wiring, and careers available in electricity.

The following filmstrips have been ordered and will be on hand to coordinate with the suggested daily teaching plans:

Electricity at Work: 417-1 Light & Heat from Electricity
417-2 'Cool' Light from Electricity
417-3 .Magnetism From Electricity
417-4..The Telegraph & Telephone
417-5..Induction & Transformers
417-6..Electrolysis & Electroplating

(Above ordered with records and 6 teacher's Guides.)

Basic Electrical Principles: 416-1..The Electric Current
416-2..Ohm's Law of Electrical Resistance
416-3..Electrical Work, Energy and Power
416-4..Direct Current Measuring Instruments

(Above ordered with records and 4 teacher's Guides.)

Suggested Daily Teaching Plans: ELECTRICITY

1 Day.....Introduction
Magnetism film

1 Day.....A-324 Magnetism & Electricity (Bd. film) 17 min. use after Pre-Test

1 Day.....Teaching text (with teacher comments) and/or class discussion

1 Day.....Diagnostic Test and checking. Begin frame sequence (Making Magnets)

1 Day.....Continue frame sequence (Making Magnets)

1 Day.....Frame sequence (cont'd) Establishing Poles, Rotate Like Motor, Floating Magnet

1 Day.....Frame sequence (cont'd) Magnetic Demonstrator. Review Test.

1 Day.....Correction of Review Test and either proceed to Pre-Test Basic Electricity or review.

1 Day.....Teaching text and class discu sion Section 1, Basic Electricity and Diagonostic Test - check answers.

2 Days.....Frame sequence Basic Electricity

1 Day.....Review Test - correction - review

1 Day.....Continue review and proceed to Pre-Test on Section 11 Electrical Circuits. Check answers.

Goals

Goal 1: The students will understand the relationship between electricity and the work of electrical engineering, technicians, salesmen, servicemen, and other workers in the field.

Objective 1 - The students will be able to difine terms related to electricity.

Objective 2 - Given a list of occupations in electricity, students will define the work of each.

Goal 11: The students will develop an understanding of the electron and atoms as it applies to electricity.

Objective 1 - Given an illustration of a simple atom, the students will be able to identify the

Objective 2 - Given an illustration of a battery and a simple circuit, the students will indicate the flow of the electrons.

Goal III: The students will have a basic understanding of magnetism.

Objective 1 - Using a film or magnetism, the students will discuss and distinguish the characteristics of magnetism.

Objective 2 - Given a bar magnet and iron filings, the students will dip the end of the magnet into the filings and will analyze the magnetic lines of force.

Objective 3 - Using a string and a magnet, the students will hang the magnet so that it swings freely until it comes to a complete stop, enabling them to identify the positive and negative poles.

Goal IV: The students will gain an understanding regarding the forms and effects of electricity.

Objective 1 - Given a piece of wool rug and a metal object, the students will produce static electricity.

Objective 2 - Given a dry cell battery and materials to complete a circuit, the students will show D.C. current in use.

Goal V: The students will have an understanding of conductors and insulators regarding their materials and uses.

Objective 1 - Given several different pieces of material, the students will distinguish good conductors from fair to poor conductors.

Objective 2 - Given several different pieces of material, the students will distinguish between a good insulator and a poor insulator.

Objective 3 - Given examples of conductors and insulators, the students will explain their uses.

Goal VI: The students will understand the relationship of electromagnetism and solenoids.

Objective 1 - Given a piece of wire, the students shape the wire into a coil, making a solenoid coil.

Objective 2 - The students will wind the coil around a soft steel core (nail, fiber, washers) making an electromagnet.

Objective 3 - The students will attach a dry cell to the electromagnet and check the polarity of each end with a compass.

Goal VII: The students will develop an understanding regarding the primary cell and the secondary cell batteries.

Objective 1 - Using a cutaway illustration of a dry cell, the students will identify the parts.

Objective 2 - Using a cutaway section of a storage battery, the students will identify the parts

Objective 3 - Using a voltmeter and three dry cell batteries, the students will hook up a series and a parallel circuit.

Goal VIII: The students will develop a basic understanding of generators and transformers.

Objective 1 - Using a cutaway illustration, the students will describe the function of a simple generator.

Objective 2 - Using a cutaway illustration, the students will explain the function and purpose of the transformer.

Goal IX: The students will have an understanding of electric meters.

Objective 1 - The students will use the following meters in figuring assigned problems - voltmeter, ohmmeter, and ammeter.

Objective 2 - The students will read a kilowatt hour meter.

Goal X: The students will have an understanding of low-voltage circuits.

Objective 1 - The students will hook up low-voltage small light circuits in series and parallel.

Objective 2 - The students will hook up a low-voltage simple bell circuit.

Goal XI: The students will have a basic understanding of electricity as it applies to the home.

Objective 1 - The students will identify electrical terms regarding house wiring.

Objective 2 - The students will replace a switch or an outlet.

Objective 3 - The students will explain the function of fuses and install them in service switch box.

Objective 4 - The students will identify different types of wire.

Goal XII: The students will have a basic understanding of small electrical motors.

Objective 1 - Using illustrations, the students will explain the difference between a D.C. and an A.C. motor.

Objective 2 - The students will build a small electric motor.

ELECTRICAL WIRING - Pre-Test

1. List three sure signs that your wiring is out of date.

   1. _____

   2. _____

   3. _____

2. The fuseless circuit-breaker type panel eliminates _____.

3. Wires are pulled through conduit by use of a _____.

4. Use of electricity has _____ in the average home in the last 30 years.

5. You can minimize danger from shocks by using one of the many types of _____ devices.

6. Joining a wire at right angles to a continuous wire is a _____.

7. What is a ground? _____

   _____

8. More than three control points require a _____ switch for each addition.

9. Thin wall conduit is easily bent with a _____.

10. There are four types of circuit failure. Name them.

    A._____ C._____

    B._____ D._____

11. _____ is a term used to indicate the voltage loss which occurs when wires are overloaded.

12. List eight commonly used electricians hand tools.

    1._____ 5._____

    2._____ 6._____

    3._____ 7._____

    4._____ 8._____

ELECTRICAL WIRING - Pre-Test Answers

Compare your answers with the expected answers given below.

	EXPECTED ANSWERS	YOUR ANSWERS Same	Different
1.	fuses blow	____	____
	lights dim, blink, flicker	____	____
	TV picture wobbles, garbles	____	____
	appliances take longer to heat and cool	____	____
	air conditioner fails to do job	____	____
2.	fuses	____	____
3.	fish tape	____	____
4.	triplex	____	____
5.	polarized	____	____
6.	tap	____	____
7.	a conductor to the earth	____	____
8.	four way	____	____
9.	conduit bender	____	____
10.	overload	____	____
	short circuit	____	____
	loose connection	____	____
	improperly seated fuse	____	____
11.	voltage loss	____	____

		Same	Different		Same	Different
12.	hammer	____	____	chisel	____	____
	5/8" drill bit	____	____	lever jaw wrench	____	____
	bit brace	____	____	linesman's pliers	____	____
	keyhole saw	____	____	wire cutter, stripper	____	____
	hack saw	____	____	jack knife	____	____
	test light	____	____	fish tape & reel	____	____
	multi-purpose tool	____	____	conduit bender	____	____
	6' folding rule	____	____	screwdriver	____	____

If all your answers are correct, take the Review Test at the end of this unit. Otherwise, continue with the teaching text.

TEACHING TEXT - Simplified Electrical Wiring Eliminate pp. 38-45

ELECTRICAL WIRING - Diagnostic Test

1. In color coding or polarization of systems, the black wire is_____ and the white wire is _____.

2. The use of electricity has tripled in the average home in the last_____ years.

3. More than _____ control points require a four way switch for each addition.

4. Voltage drop is a term used to indicate the _____ _____ which occurs where wires are overloaded.

5. Wires are pulled through conduit by use of a _____ _____.

6. List twelve commonly used electricians hand tools.

1._____ 7._____
2._____ 8._____
3._____ 9._____
4._____ 10._____
5._____ 11._____
6._____ 12._____

7. List the four most common types of wiring installations.

1._____ 3._____
2._____ 4._____

8. What does U.L. approved mean? _____

9. List five sure signs that your wiring is out of date.

1._____ 4._____
2._____ 5._____
3._____

10. _____ is the unit used in measuring electrical rate of flow.

11. An improper connection between a hot wire and neutral wire is called a _____ _____.

12. What is a ground? _____

13. There are four types of circuit failure. Name them.

1._____ 3._____
2._____ 4._____

14. List the four steps in getting off to the right start on wiring projects.

1._____ 3._____
2._____ 4._____

ELECTRICAL WIRING - Diagonistic Test Answers

Compare your answers with the expected answers given below

	EXPECTED ANSWERS	YOUR ANSWERS	
		Same	Different
1.	hot	___	___
	neutral	___	___
2.	thirty (30)	___	___
3.	three (3)	___	___
4.	voltage loss	___	___
5.	fish tape	___	___

6.		Same	Different		Same	Different
	hammer	___	___	chisel	___	___
	5/8' drill bit	___	___	lever jaw wrench	___	___
	bit brace	___	___	linesman's pliers	___	___
	keyhole saw	___	___	wire cutter, stripper	___	___
	hack saw	___	___	jack knife	___	___
	test light	___	___	fish tape & reel	___	___
	multi-purpose tool	___	___	conduit bender	___	___
	6' folding rule	___	___	screwdriver	___	___

7.	indoor plastic sheathed	___	___
	dual purpose	___	___
	flexible armored cable	___	___
	conduit	___	___
8.	safety certified by an independent laboratory Underwriters Approved	___	___
9.	fuses blow	___	___
	lights dim, blink, flicker	___	___
	TV picture wobbles, shrinks	___	___
	appliances take longer to operate	___	___
	air conditioner fails to do job	___	___
10.	Ampere	___	___
11.	short circuit	___	___
12.	a conductor to the earth	___	___

ELECTRICAL WIRING - Diagnostic Test Answers (cont'd)

	EXPECTED ANSWERS	YOUR ANSWERS	
		Same	Different
13.	overload	___	___
	short circuit	___	___
	loose connection	___	___
	improperly seated fuse	___	___
14.	prepare work plans	___	___
	check with power company	___	___
	Is permit necessary?	___	___
	check local regulations	___	___

If all your answers are correct, take the Review Test at the end of this unit. Otherwise, continue with the frame sequence.

ELECTRICAL WIRING - Frame Sequence

Each frame sequence will follow by section the electrical wiring handbook published by Sears. This is the same handbook used as a teaching text.

EW-1 Most homes ten years old or older are probably in need of a good wiring check-up. For this exercise, you will learn what to look for when making a check-up at your own house. A very quick check can be made by:

a. observing; Does the TV picture wobble and shrink?

b. asking; When was the last time a fuse blew and why?

c. looking; What is the current capacity of the entrance panel?

d. checking; Is your panel fused or does it have circuit breakers?

Copy the above questions and complete the survey of your home. What changes would be necessary to bring your house up to full house power?

On page 7 of the handbook, there are 22 circuits in the entrance panel. Figure the total watts used if all appliances and lights were used at the same time. TOTAL _____.

What is the maximum carrying capacity for a 20 ampere general purpose or appliance circuit with number 12 wire? _____

EW-2 Every job should be started with proper planning. Electric wiring is no different.

List and explain the 4 things that should be done to get off to the right start on your wiring project.

1. _____

2. _____

3. _____

4. _____

Whose responsibility is it to install the service entrance on new home construction? _____

What is a ground? _____

Diagram the usual method of grounding a city or town system.

EW-3 According to the text material, wires are packaged together in several ways. Each type thus becomes suitable for a particular application.

Which wire would be used to wire a new residence?_____

Which type would be used to wire an outdoor post lantern?_____

What situations call for the use of flexible armored cable?_____

_____

Procure the needed wire boxes and accessories and wire the single simplified circuit on page 15. Check first with your teacher concerning modifications of the circuit.

Check your circuit for operation after review of your work by your teacher.

Do the lights operate? _____

Do the receptacles operate? _____

What is used to simplify the connection of a ground wire to a box?

_____

How does an old work box differ from a new work box? _____

_____

_____

List three problems which might be encountered when installing boxes in old homes.

1. _____

2. _____

3. _____

EW-4 Secure the necessary wire, switches, boxes, and accessories and wire a light operated from two switches. Refer to page 24, drawing 2. Check operation after instructor checks.

Add one additional switch so that the light may be operated from three positions. Check operation after instructor checks.

Is a white wire used as other than neutral? _____ If so, in what application? _____

If a white wire is used for another purpose, how do you avoid confusion with the neutral? _____

_____

Sketch the hole configuration for the following polarized plugs:

15 Amp 240 V

20 Amp 240 V

30 Amp or less 120/240 V

50 Amp or less 120/240 V

Should major appliances operating on 220 Volts have their own individual circuits? _____

In wire color coding, what is the green wire used for? _____

_____

EW-6 Joining ends of 2 wires together is a splice. Joining a wire at right angles to a continuous wire is a tap. For the following exercise, you will make a splice, tap, connection at a screw terminal and install a solderless terminal connected at a screw. Mount these on a board as shown.

The proper size of wire is very important to efficient operation of an electric motor.

What size wire should you use for a $\frac{1}{4}$ HP 240 volt motor used 300 ft. from the power source? _____

Give the meaning of voltage drop. _____

What should be done in the planning stage so voltage drop through extension cords is not a problem? _____

_____

Often times you will see a U.L. tag on the cord of an appliance or lamp. What does this mean to you? _____

Should you look elsewhere for a stamp or tag?_____ If so, why?_____

_____

Protection from a short circuit or overloaded circuit is necessary. What is the safety device which does this job? _____

Why do we tie an underwriter's knot at the plug end of an extension cord?

_____

What is a procedure that can be used in locating a short circuit?

_____

With a circuit tester - Remember: If lamp glows the fuse is _____;
If the lamp does not glow, _____ fuse.

How does a fuse work? _____

_____

Fuses and breakers are _____ to protect the home and the electrical supply to the home.

Why do circuits fail? _____

_____

A _____ of your wiring system will help you check for overloads.

EW-9 Underground wires must be installed in _____ lengths.

EW-10 The small leakage of hazardous electrical current may not blow a fuse or trip a greaker, but still be a shock hazard. Such a hazzard may be guarded against by use of a _____.

EW-11 In a fuseless electric control center, fuses are replaced by _____

_____.

ELECTRICAL WIRING - Review Test

1. What is a ground? _____

2. Use of electricity has _____ in the average home in the last 30 years.

3. List the four most common types of wiring installations.

   1. _____
   2. _____
   3. _____
   4. _____

4. Check _____ capacity of conduit before installation.

5. Major appliances need _____ _____ wire.

6. List sixteen commonly used electricians hand tools.

   1. _____ 9. _____
   2. _____ 10. _____
   3. _____ 11. _____
   4. _____ 12. _____
   5. _____ 13. _____
   6. _____ 14. _____
   7. _____ 15. _____
   8. _____ 16. _____

7. _____ is a term used to indicate the voltage loss which occurs when wires are overloaded.

8. Wires are pulled through conduit by use of a _____ _____.

9. List the four most common types of circuit failure.

   1. _____ 3. _____
   2. _____ 4. _____

10. More than three control points require a _____ switch for each addition.

11. An improper connection between a hot wire and neutral wire is called a _____.

12. _____is the unit used in measuring electrical rate of flow.

13. _____is the unit used in measuring electrical pressure.

14. _____is the unit which shows current drain with both voltage and amperage considered.

ELECTRICAL WIRING - Review Test (cont'd)

15. What does U.L. approved mean? _____

_____

16. List five sure signs your wiring is out of date.
    1. _____
    2. _____
    3. _____
    4. _____
    5. _____

17. The fuseless circuit breaker type panel eliminates _____.

18. Code requirement - All receptacles must be _____ type for new work or replacement on grounded systems.

19. In color coding or polarization of systems, the black wire is _____ and the white wire is _____.

20. Thin wall conduit is easily bent with a _____ _____.

21. Boxes are made of _____ and _____.

22. List the four steps in getting off to the right start on wiring projects.
    1. _____
    2. _____
    3. _____
    4. _____

23. All wire connections must be made within a _____.

24. Joining a wire at right angles to a continuous wire is a _____.

25. Joining ends of 2 wires together is a _____.

26. Give a brief explanation of how overload on a circuit is determined.

_____

_____

27. In an underground wiring installation, conduit or wire should be buried _____ inches below the surface.

28. In an underground installation, the ground wire need not be _____.

29. _____ is designed to detect and interrupt the power supply quickly enough to prevent a serious problem.

30. Minimize danger from shocks by using one of the many types of _____ _____ devices.

ELECTRICAL WIRING - Review Test Answers

Compare your answers with the expected answers given below

	EXPECTED ANSWERS	YOUR ANSWERS	
		Same	Different
1.	conductor to earth	___	___
2.	tripled	___	___
3.	indoor plastic sheathed	___	___
	dual purpose	___	___
	flexible armored cable	___	___
	conduit	___	___
4.	wire	___	___
5.	heavy duty	___	___

		Same	Different			
6.	hammer	___	___	chisel	___	___
	5/8" drill bit	___	___	lever jaw wrench	___	___
	bit brace	___	___	lineman's pliers	___	___
	keyhole saw	___	___	wire cutter, stripper	___	___
	hack saw	___	___	jack knife	___	___
	test light	___	___	fish tape & reel	___	___
	multi-purpose tool	___	___	conduit bender	___	___
	6' folding rule	___	___	screwdriver	___	___

7.	Voltage drop	___	___
8.	fish tape	___	___
9.	short circuit	___	___
	loose connection	___	___
	overload	___	___
	improperly seated fuse	___	___
10.	four way	___	___
11.	short circuit	___	___
12.	Ampere	___	___
13.	Volt	___	___
14.	Watt	___	___
15.	underwriter's laboratory approved	___	___

ELECTRICAL WIRING - Review Test Answers (cont'd)

	EXPECTED ANSWERS	YOUR ANSWERS	
		Same	Different
16.	fuses blow	___	___
	lights dim, blink, flicker	___	___
	TV picture wobbles, shrinks	___	___
	appliances take longer to heat or cool	___	___
	air conditioners fail to do job	___	___
17.	fuse	___	___
18.	grounded	___	___
19.	hot	___	___
	neutral	___	___
20.	conduit bender	___	___
21	plastic	___	___
	steel	___	___
22.	prepare work plans	___	___
	check with power company	___	___
	Is permit necessary?	___	___
	check local regulations	___	___
23.	box	___	___
24.	tap wire	___	___
25.	splice	___	___
26.	conduct a circuit survey	___	___
27.	18 to 24 inches	___	___
28.	insulated	___	___
29.	Ground Fault indicator	___	___
30.	polarized	___	___

If ALL your answers match the expected answers, go on th the Pre-Test of the next unit.

If any of your answers did not match the expected answers, refer to below:

If you arrived at this Review Test from the Pre-Test, begin with the teaching text.

If you arrived at this Review Test from the Diagnostic Test or Frame Sequence, begin with the Frame Sequence.

LIST OF MATERIALS:

1 pc. $\frac{1}{4}$ x $2\frac{1}{4}$ round C.R. steel
? ft. #22 insulated wire
2 pcs. $2\frac{1}{4}$ x 14 heavy Kraft paper
1 pc $2\frac{1}{2}$ x 14 heavy Kraft paper
1 pc. 5/16 x 6 24 gauge steel
1 pc. #22 nichrome wire 3/4"
1 no. 6 x $\frac{1}{4}$ machine screw
1 small alligator clip No. 60S
2 solderless or crimp lugs
1 #72B wire nut
3 ft. parallel zip cord

INDUSTRIAL EDUCATION

Mini-Course - Grade 9: SMALL ENGINES

PROGRAM DESCRIPTION

Small Engines is an elective course that is offered at the ninth grade level to boys and girls in the junior high schools. Classes meet fifty minutes daily, five days a week for six weeks.

This course is one of three courses and offered as a semester unit in Industrial Education. The unit consists of Electricity, Small Engines, and Bicycles.

Small Engines is exploratory in nature. The students will spend time studying the construction, operation, care and maintenance of the small gasoline engine. Through manipulative experiences with the various components such as carburetor, ignition, cooling, and lubrication, the students will have the opportunity to learn how they are constructed and how they relate to each other working as a whole unit.

The students will also study the many careers closely allied to small gasoline engines.

TABLE OF CONTENTS

Page	1	Course Summary
Page	2	Suggested Materials
Page	2	List of Units
Page	3	Unit I - Introduction
Page	5	Unit II - Basic Engine Construction
Page	7	Unit III - Fuel Systems
Page	10	Unit IV - Ignition System
Page	12	Unit V - The Cooling System
Page	14	Unit VI - Lubrication System
Page	17	Unit VII - Trouble Shooting and Maintenance
Page	19	Unit VIII - Career Opportunities
Page	19	Unit IX - Safety
Page	21	Suggested Audio-Visual aids
Page	21	Bibliography

SMALL ENGINES - Suggested Materials

3 4 cycle engines

3 2 cycle engines

6 tool kits

1 small Motor Tool Panel #186949 B.G. Cat.

Valve Spring compressor
Cylinder gage
Piston ring expander
Piston ring compressor
Piston groove cutter and cleaner
Cylinder ridge reamer
Valve grinder
Valve refacer
Gear puller
Magnetic key inserter

Tachometer

Compression gage

Feeler gage

Spark plug gapping tool

Torque wrench - inch pounds

30 copies Small Gasoline Engines - Stephenson

6 copies Small Engines Service Manual

30 Copies Power Mechanics - Pat H. Atteberry

SMALL ENGINES - Suggested Schedule by Units

Unit I:	Introduction to Small Engine and Consumer Knowledge	3 Days
Unit II:	Basic Engine Construction	2 Days
Unit III:	Fuel System - Carburetion	5 Days
Unit IV:	Ignition System	5 Days
Unit V:	Cooling System	3 Days
Unit VI:	Lubrication System	3 Days
Unit VII:	Trouble Shooting and Maintenance (This unit may be taught during system units.)	5 Days
Unit VIII:	Career Opportunities	2 Days
Unit IX:	Safety (Covered when needed during the other units.	

The above schedule is suggested and allows flexibility. The instructor may vary his time as needed.

SMALL GASOLINE ENGINE - Unit I - Introduction

Goals

1. The students will develop an awareness of the various types of small engines used today for both work and pleasure.
2. The students will develop consumer knowledge of the various small gasoline engines, so they can choose their power equipment wisely.

REQUIRED	SKILLS	CRITERIA
1. Given an example of each type of gasoline engine	The students will be able to distinguish the differences between each type of engine	According to the manufacturer's specifications
2. Given an example of the four stroke engine	The students will be able to explain the four stroke theory	According to teacher specifications
3. Given an example of the two stroke engine	The students will be able to explain the two stroke theory	According to teacher specifications
4. Given an example of the rotary engine	The students will be able to explain the rotary bombustion theory.	According to teacher specifications
5. Given the basic requirements for a job (example: lawn mowing)	The students will evaluate and choose the proper type and size engine for the job	Within ½ HP of requirement
6. Given the basic differences of fuel requirement for 2 cycle & 4 cycle engines	The students will give the advantage and disadvantage of each	To teacher specified requirements
7. Given the basic differences of the 2 cycle & 4 cycle valve systems	The students will give the advantage and disadvantage of each	To teacher specified requirements
8. Given all the facts concerning the advantages and disadvantages of each type of engine	The students will compare and choose the engine that fits their own needs	The requirements and choice of the students

Evaluation Procedure

Goal 1 - Objectives 1, 2, 3, 4 - Teacher designed report or test

Goal 2 - Objectives 5, 6, 7 - Teacher designed report and survey

Objective 8 - Student designed survey

Unit I - Test

NOTE: Figure #1 should show the four cycles of a 4 cycle engine
Small Engines - pg. 17 - Fig. 3-24

Figure #2 should show the two cycles
Small Gasoline Engines - pg. 19 - Fig. 3-26

SMALL GASOLINE ENGINE - Unit I - Test

What view in Figure #I are the following strokes?

1. Intake _____

2. Exhaust _____

3. Compression _____

4. Power _____

What views in Figure #2 are the:

5. Power stroke _____

6. Compression stroke _____

7. On a two cycle engine, when does the fuel intake and exhaust occur?

_____

8. How is the two cycle lubricated? _____

_____

9. How many revolutions are required to complete the four-cycles?_____

10. How many revolutions are required to complete the two-cycles?_____

11. How does the rotary engine differ from the piston engine?_____

_____

_____

_____

12. What is the function of the reed value of the two-cycle engine?_____

_____

_____

13. How is the four cycle engine lubricated? _____

_____

14. What has replaced the intake and exhaust valve on the two cycle engine?

_____

15. Do you mix gas and oil on the four cycle engine?_____

SMALL GASOLINE ENGINE - Unit II - Engine Construction

Goals

1. The students will understand the function and construction of the cylinder, cylinderhead, piston assembly, crankcase components, and valve assembly of a small gasoline engine.

REQUIRED	SKILLS	CRITERIA
1. Given an example of a small gasoline engine	The students will identify the cylinder, cylinderhead, piston, piston rings, piston pin, connecting rod, crankshaft, intake valve, exhaust valve, flywheel, and crankcase of the small gasoline engine	According to the manufacturer's definition
2. Given an example of a small gasoline engine	The students will explain the function of the cylinder, cylinderhead, piston, piston rings, piston pin, connecting rod, crankshaft, camshaft, intake valve, flywheel, and crankcase of a small gasoline engine	According to manufacturer's specification

Evaluation Procedure

Goal I - Objectives 1, 2 - Teacher designed paper or test

Unit II - Test

Test on following page.

SMALL GASOLINE ENGINE - Unit II - Test

From the explodes view on the next page, identify the following

1. cylinder _____
2. cylinderhead _____
3. piston _____
4. piston ring _____
5. piston pin _____
6. connecting rod _____
7. crankshaft _____
8. camshaft _____
9. intake valve _____
10. exhaust valve _____
11. flywheel _____
12. crankcase _____

Explain the function of the following parts.

13. cylinder _____
14. cylinderhead _____
15. piston _____
16. piston ring _____
17. piston pin _____
18. connecting rod _____
19. crankshaft _____
20. camshaft _____
21. intake valve _____
22. exhaust valve _____
23. flywheel _____
24. crankcase _____
25. carburetor _____

SMALL GASOLINE ENGINE - Unit III - Fuel System -- Carburetion

Goals

1. The students will understand the function and construction of the fuel system of a small gasoline engine.
2. The students will know the different types of carburetors available.
3. The students will understand the refining process of gasoline.

REQUIRED	SKILLS	CRITERIA
1. Given a diagram of a small gas engine fuel system	The students will identify the carburetor, fuel tank, fuel line, air cleaner, intake, manifold, fuel pump, and choke	According to manufacturer's specifications
2. Given a diagram of a small gas engine fuel system	The students will explain the function of each part	According to manufacturer's specifications
3. Given a diagram of a Gravity feed carburetor and suction feed system	The students will compare and contrast the function of each	According to manufacturer's specifications
4. Given a diagram of a fuel pump type fuel system	The students will explain the function of the fuel pump in this system	According to manufacturer's specifications
5. Given an example of a pressurized fuel system	The students will explain the function of the pressurization	According to manufacturer's specifications
6. Given a diagram of a diaphragm carburetor	The students will explain the function of the diaphragm carburetor	According to manufacturer's specifications
7. Given a diagram of a carburetor	The students will be able to identify the venturi, throttle valve, float, needle vale, choke	According to manufacturer's specifications
8. Given a diagram of a carburetor	The student will be able to explain the function of each part	According to manufacturer's specifications
9. Given a diagram of a carburetor	The students will define and describe the principles of carburetion	According to teacher's specification
10. Given a diagram of the carburetor venturi and throttle valve	The students will be able to define and explain atomization	According to teacher's specifications

REQUIRED	SKILLS	CRITERIA
11. Given a small engine carburetor	The students will successfully disassemble and reassemble the carburetor	According to manufacturer's specifications
12. Given a diagram of a bubble tower	The students will describe the tower and its function	According to teacher's specifications
13. Given a diagram of a bubble or fractioning tower	The students will define and explain the refining process	According to teacher's specifications

Evaluation Procedure

Goal 1 - Objectives 1, 2 - Teacher designed test

Goal 2 - Objectives 3, 4, 5, 6, 7, 8, 9, 10 - Teacher designed report of test

Objective II - Teacher observation

Objectives 12, 13 - Teacher designed test

Unit III - Test

Test on following page.

SMALL GASOLINE ENGINE - Unit III - Test

From the diagram, identify the following parts.

1. carburetor _____ 5. intake manifold _____

2. fuel line _____ 6. fuel pump _____

3. fuel tank _____ 7. choke _____

4. air cleaner _____

8. How does a gravity feed carburetor get its fuel? _____

_____

9. How does a suction carburetor get its fuel? _____

_____

10. How does the fuel pump system work? _____

_____

_____

11. How does the pressure system work? _____ _____

_____ _____

_____

What is the function of:

12. air cleaner _____

13. choke _____

14. throttle _____

15. venturi section _____

SMALL GASOLINE ENGINE - Unit LV - Ignition System

Goals

1. The students will understand the function and construction of the ignition system of the small gasoline engine.

2. The students will understand magnetically induced electrical current.

REQUIRED	SKILLS	CRITERIA
1. Given an example of the parts of the ignition system	The students will explain the construction and function of the magneto, coil, condensor, breaker points, breaker cam, and spark plug	According to manufacturer's specifications
2. Given a list of terms and their definitions	The students will define the terms - volt, ohm, amp, Ohms Law, magnetism	According to teacher's requirements
3. Given a small gasoline engine, a new spark plug, a new set of contact points, and a new condensor	The students will successfully perform a tune-up	The engine will run according to manufacturer's specifications

Evaluation Procedure

Goal 1 - Objective 1 - Teacher Test

Objective 3 - Teacher Observation

Goal 2 - Objective 2 - Teacher Test

Unit LV - Test

Test on following page.

SMALL GASOLINE ENGINE - Unit IV - Test

What is the function of the following ignition parts?

1. magneto _____
2. coil _____
3. condensor _____
4. breaker points _____
5. breaker cam _____
6. spark plug _____
7. Why must the spark [illegible] speed? _____

_____

In what four ways do spark plugs differ?

8. _____
9. _____
10. _____
11. _____
12. What is the approximate voltage across the spark plug? _____
13. Define magnetic induction. _____

_____

14. Define volt. _____

_____

15. Define ohm. _____

_____

16. Define amp. _____

_____

SMALL GASOLINE ENGINE - Unit V - The Cooling System

Goals

1. The students will understand the function and construction of the cooling system of a small gasoline engine.

REQUIRED	SKILLS	CRITERIA
1. Given a diagram of the two types of cooling systems	The students will analyze and compare both systems	According to teacher's requirements
2. Given a diagram of an air cooled engine	The students will explain the function and construction of the heat radiating fins, flywheel blower, and air shrouds	According to manufacturer's specifications
3. Given a diagram of a water cooled engine	The students will explain the construction and function of the radiator, fan, thermostat, hoses, water jacket, and water pump	According to manufacturer's specifications
4. Given a diagram of an outboard motor water cooling system	The students will compare and contrast it with the regular water cooled system	According to teacher's specifications
5. Given an air cooled engine	The students will remove the air shroud, clean and inspect the fins, inspect the flywheel, and replace the shroud	According to teacher's specifications
6. Given a water cooled engine	The students will drain, flush, and refill the radiator with the proper coolant	According to manufacturer's specifications
7. Given a water cooled outboard engine	The students will properly flush out and lubricate the underwater points on the outboard motor	According to manufacturer's specifications

Evaluation Procedure

Goal 1 - Objectives 1, 2, 3, 4 - Teacher designed report or test

Objectives 5, 6, 7 - Teacher observation

Unit V - Test

Test on following page.

SMALL GASOLINE ENGINE - Unit V - Test

What is the function of the following parts of the cooling system?

1. fins _____
2. flywheel _____
3. air shroud _____
4. What can be the result of a chipped or missing fin? _____

   _____
5. What can be the result of a missing flywheel vane? _____

   _____

What is the function of the following parts of the water cooled system?

6. radiator _____
7. fan _____
8. thermostat _____
9. water pump _____
10. hoses _____
11. waterjacket _____
12. What is the approximate operating temperature of the water cooled system?

    _____
13. How does the outboard water cooled system differ from the standard type?

    _____

    _____
14. How high do the combustion chamber temperatures get? _____
15. Why are air cooled systems used for portable equipment? _____

    _____

SMALL GASOLINE ENGINE - Unit VI - Lubrication System

Goals

1. The students will understand the construction and function of the lubricating system of a small gasoline engine.

2. The students will understand the American Petroleum Institute quality designation and viscosity classification of lubricating oils.

REQUIRED	SKILLS	CRITERIA
1. Given a complete oil chart	The students will describe the five functions of oil	According to A.P.I. and S.A.E. specifications
2. Given a complete chart of A.P.I. quality designation	The students will define the five A.P.I. letter designations of service	According to A.P.I. specifications
3. Given a chart of viscosity classification by S.A.E.	The students will define the viscosity numbers and their use	According to S.A.E. specifications
4. Given a list of oil additives	The students will explain their use	According to manufacturer's specifications
5. Given a diagram of each type of engine lubrication system	The students will compare and contrast the two cycle system with the four cycle system	According to teacher's specifications
6. Given a diagram of the four cycle lubrication system	The students will describe each type of system; simple splash constant level splash, ejection pump, barrel type pump, full pressure lubrication	According to manufacturer's specifications
7. Given a diagram of the two cycle system of lubrication	The students will describe the operation of the two cycle lubricating system	According to manufacturer's specifications
8. Given the manufacturer's requirements for lubrication of a four cycle engine	The students will plan a systematic procedure for maintaining the lubrication system	According to manufacturer's specifications
9. Given the manufacturer's requirements for lubrication of a two cycle engine	The students will list the procedure for mixing the gas-oil fuel mixture	According to manufacturer's specifications

REQUIRED	SKILLS	CRITERIA
10. Given the procedure for changing engine oil	The students will successfully change the engine oil	According to manufacturer's specifications
11. Given the requirements for lubrication of other mechanical components of the product	The students will successfully lubricate these parts	According to manufacturer's requirements

Evaluation Procedure

Goal 1 - Objectives 5, 6, 7, 8, 9 - Teacher designed test or report
NOTE: Objective 8 - the report refers to a written homework paper

Objectives 10, 11 - Teacher observation

Goal 2 - Objectives 1, 2, 3, 4 - Teacher designed test or report

Unit VI - Test

Test on following page.

SMALL GASOLINE ENGINE - Unit VI - Test

List the five functions of oil.

1. _____ 4. _____
2. _____ 5. _____
3. _____

What is the function of the three friction bearings?

6. journal _____
7. guide _____
8. thrust _____

What are three types of anti-friction bearings?

9. _____
10. _____
11. _____

12. Define viscosity. _____

Define the following additives.

13. pour point depressant _____
14. oxidation and bearing corrosion inhibitor _____
15. rust and corrosion inhibitors _____
16. detergent/dispersant additives _____
17. foam inhibitors _____

18. What do the A.P.I. letter classifications mean? _____

_____

19. What service letters are recommended for small engines? _____

20. Can you use any type of oil in a two cycle engine? _____

Explain briefly the five types of lubrication systems in small engines.

21. simple splash _____
22. constant level splash _____
23. ejection pump _____
24. barrel type pump _____
25. full pressure lube _____

SMALL GASOLINE ENGINE - Unit VII - Troubleshooting and Maintenance

Goals

1. The students will learn to properly maintain and care for products equipped with small gasoline engines.

2. The students will develop an ability to analyze and solve problems that commonly occur in the performance of small engines.

REQUIRED	SKILLS	CRITERIA
1. Given the manufacturer's requirements for maintenance of all systems of the small gasoline engine	The students will develop a systematic method of maintaining all components of the small gasoline engine	According to manufacturer's specifications
2. Given a step by step list of winter storage requirements	The students will successfully complete the proper preparation for winter storage	According to manufacturer's specifications
3. Given the manufacturer's list of requirements to put an engine into service	The students will prepare an engine for service from winter storage	According to manufacturer's specifications
4. Given a step by step procedure for troubleshooting a malfunctioning engine	The students will be able to recognize and locate the problem as to: 1. electrical 2. fuel 3. mechanical	According to teacher's specifications
5. Given an engine with a known malfunction	The students will be able to accomplish the necessary skills to get the engine to operate	According to manufacturer's specifications

Evaluation Procedure

Goal 1 - Objective 1 - Teacher designed test or report

Objectives 2, 3 - Teacher observation

Goal 2 - Objective 4 - Teacher observation or designed test

Objective 5 - Teacher observation

Unit VII - Test

Test on following page.

SMALL GASOLINE ENGINE - Unit VII - Test

What are the four basic points to be considered in routine maintenance?

1. _____

2. _____

3. _____

4. _____

5. What is the proper length of time to change oil on a B & S or Clinton engine? _____

6. What is the proper length of time to change oil on a Lauson engine?

_____

7. What is the purpose of the air filter? _____

_____

What are the two types of air filters?

8. _____

9. _____

10. What is the most common time between spark plug changes? _____

_____

List the five items that need to be accomplished on an engine for winter storage.

11. _____

12. _____

13. _____

14. _____

15. _____

SMALL GASOLINE ENGINE - Unit VIII - Careers

Goals

1. The students will recognize the various career opportunities available to them in the small engine related field.

REQUIRED	SKILLS	CRITERIA
1. Given a guest speaker on the topic of career exploration of small engines	The students will interact through discussion on the topic	Time available
2. Given a career survey form	The students will interview parents, friends, and neighbors to determine the various roles small engines play in their vocations	
3. Given a field trip	The students will explore career opportunities in small engine related fields	
4. Given a movie or filmstip	The students will explore career opportunities in small engine related fields	

Evaluation Procedure

Goal 1 - Objectives 1, 2, 3, 4 - Teacher observation

SMALL GASOLINE ENGINE - Unit IX - Safety

Goals

1. The students will develop an awareness of the safe practices involved in the care maintenance and use of small engines.

REQUIRED	SKILLS	CRITERIA
1. Given a list of safety rules pertaining to small engines	The students will explain each rule	According to teacher's specifications
2. Given a list of safety rules pertaining to small engines	The students will work and observe these rules	According to teacher's specifications

Evaluation Procedure

Goal 1 - Objective 1 - Teacher designed test

Objective 2 - Teacher observation

Unit IX - Test

Test on following page.

SMALL GASOLINE ENGINE - Unit IX - Test

1. Why is it unsafe to operate a gasoline engine in a closed building?

_____

_____

2. Why is it a dangerous practice to refill a hot engine?

_____

_____

3. Why is it unsafe to make any adjustments to machinery that is running?

_____

_____

4. Keeping gasoline in the basement is dangerous. Why?

_____

_____

SMALL GASOLINE ENGINE - Suggested Audio-Visual Aids

"Dirt - Engine Enemy Number One" (10 minutes)

Dana Corporation
Librarian - School Assistance
Technical Service Department
Hagerstown Distribution Center
P.O. Box 500
Hagerstown, Indiana 47346

"Oil" (18 minutes) (4 weeks advance notice)

Shell Film Library
450 North Meridial Street
Indianapolis, Indiana 46204

"Spark in Time on the Firing Line" (22 minutes)

"The Power of Spark" (14 minutes)

Champion Spark Plug Company (2 months advance notice)
Film Department
900 Upton Avenue
Box 910
Toledo, Ohio 43601

Cat. #186715 - 2 cycle - 35MM - colored slide set #S2C

Cat. #186726 - 4 cycle - 35MM - colored slide set #S4C

Cat. #186737 - Tecumseh Float Type Carb - Wall chart #TCF

Cat. #186748 - Tecumseh Diaphragm Type Carb - Wall chart #TCD

Broadhead Garrett Cat. Page 661
4560 East 71st Street
Cleveland, Ohio 44105

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Power Mechanics, Pat Atteberry, Goodheard-Wilcox, Chicago, Illinois, 1961

Small Engines Service Manual, Technical Publications Division Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105, 1973